Windscreen wiper linkage ball and socket joint assembly

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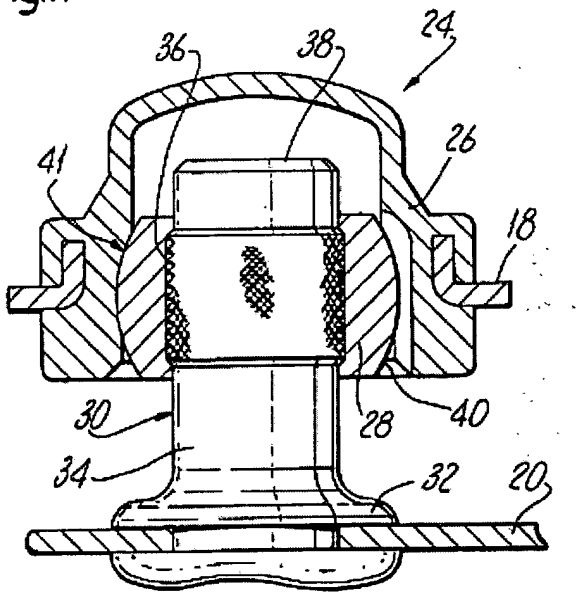
Abstract of **GB2102061**

In a windscreen wiper linkage ball and socket joint assembly 24, a socket portion 26 is formed from a mouldable non-metallic synthetic composition, such as glass-fibre filled synthetic polyamide, and a ball portion 28 is formed by injection-moulding about a knurled shank 34 of a metal pin 30 an acetal copolymer containing polytetrafluoroethylene dispersed therein a bearing lubricant material.

Fig.7.



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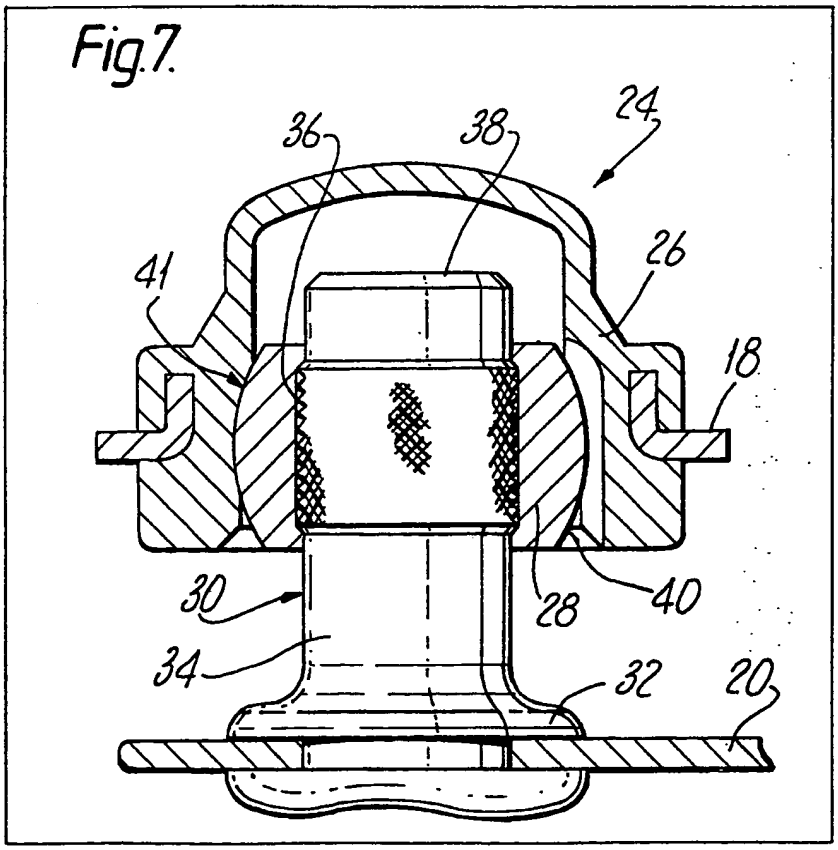
(54) Windscreen wiper linkage ball and socket joint assembly

(57) In a windscreen wiper linkage ball and socket joint assembly 24, a socket portion 26 is formed from a mouldable non-metallic synthetic composition, such as glass-fibre filled synthetic polyamide, and a ball portion 28 is formed by injection-moulding about a knurled shank 34 of a metal pin 30 an acetal copolymer containing polytetrafluoroethylene dispersed therein a bearing lubricant material.



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The drawings originally filed were informal and the print here reproduced is taken from a later filed formal copy.

Fig.1.

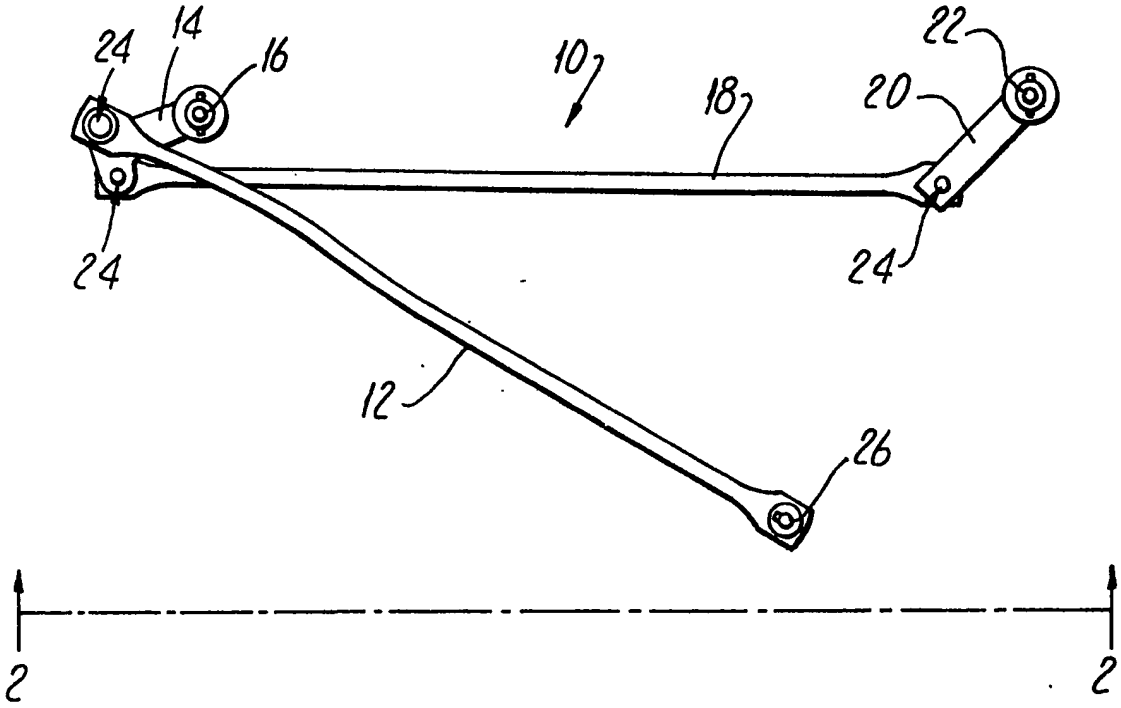

Fig.2.

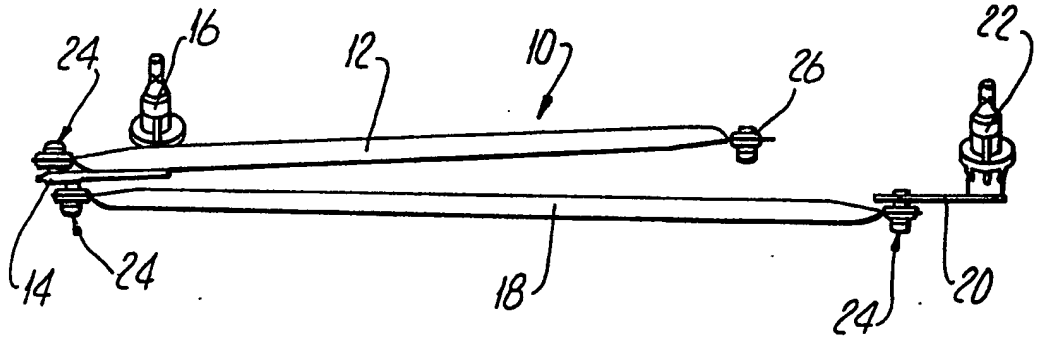

Fig.3.

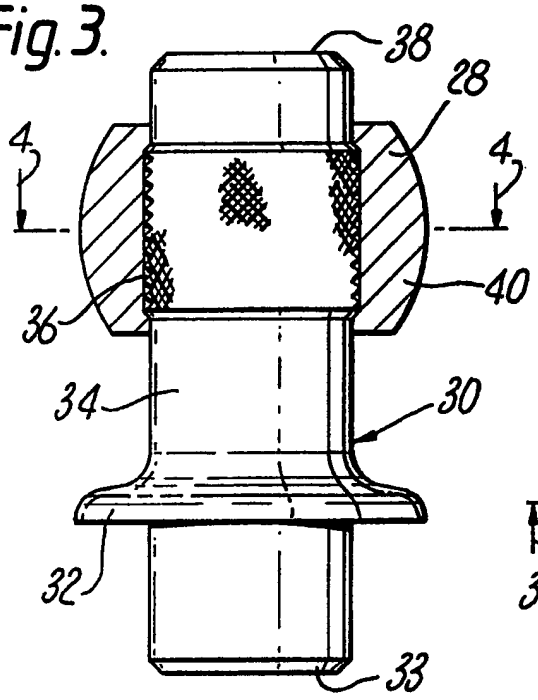

Fig.4.

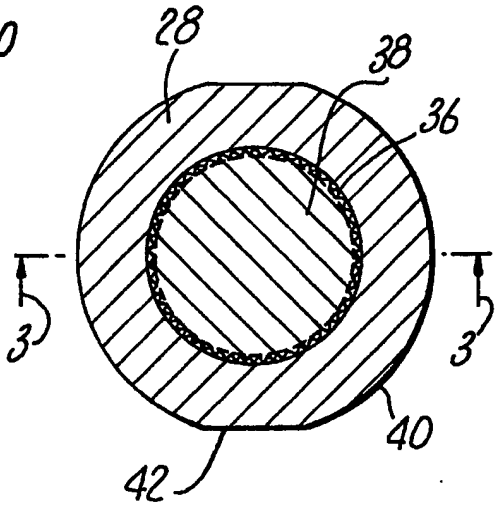

Fig.5.

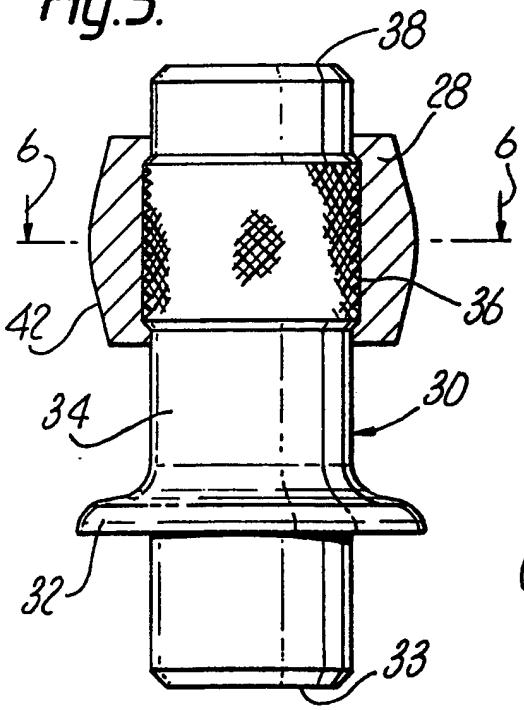

Fig.6.

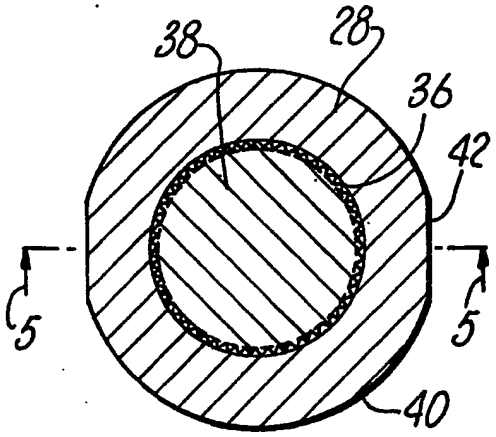

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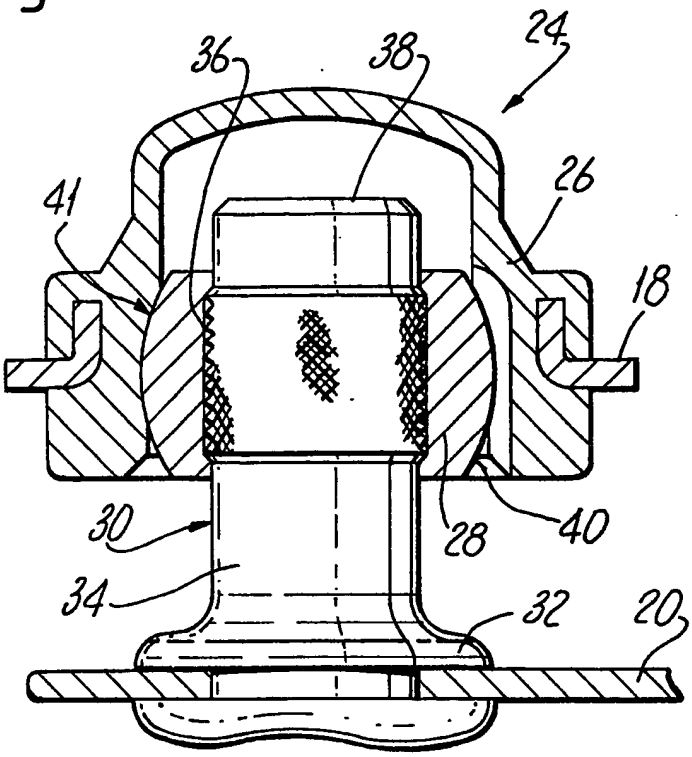
Fig.7.



SPECIFICATION

Windscreen wiper linkage ball and socket joint assembly

This invention relates to windscreen wiper linkage ball and socket joint assemblies, and, in particular, to windscreen wiper linkage ball and socket joint assemblies in which the socket portion of the assembly is formed from a synthetic mouldable non-metallic composition.

It is customary for windscreen wiper assemblies of motor vehicles to comprise at least two windscreen wiper blades carried on separate pivoted arms which are connected to a common windscreen wiper motor by a system of linkages involving a number of ball and socket universal joints. Such linkages are almost invariably housed in locations in motor vehicles such that the linkage joints are relatively inaccessible. Consequently it is essential that these linkage joints can function for protracted periods with a minimum of maintenance.

Windscreen wiper linkage ball and socket joint assemblies having a long service life are known, in which the socket portion of the assembly is formed from a synthetic mouldable non-metallic composition, such as a glass fibre-reinforced non-metallic polyamide material. One such material is a 30% glass fibre-filled Nylon 12 sold by Vestamid under the trade designation L-1930 Black 97503. The ball portion customarily used with such a non-metallic socket is made of steel. It has been found that such non-metallic sockets are very hard and very stable dimensionally, but that, during use, the glass fibre filler tends to wear away to form a glass powder within the joint which can severely abrade an untreated steel ball portion. To overcome this effect, the steel ball portion is machined to a very high finish, a very hard electroless nickel coating is deposited on the steel ball portion, and then the coated ball portion is highly burnished to obtain a contact surface which is glass hard. Although this procedure overcomes the problem of ball portion wear, it makes the cost of the finished ball portion extremely high.

A windscreen wiper linkage ball and socket joint assembly according to the present invention is an assembly in which the socket portion is formed from a mouldable non-metallic synthetic composition and the ball portion is formed by injection moulding about a knurled shank of a metal pin an acetal copolymer containing dispersed therein a bearing lubricant material.

Preferably, the acetal copolymer used is an acetal copolymer modified with polytetrafluoroethylene. An example of such a copolymer is manufactured by Hoechst Chemicals under the trade name of Hostaform (registered trade mark) C9021 TF.

The ball portion may be formed as a spherical shape about the metal pin, but, advantageously, the shape of the ball portion is that of an annular torus surrounding the shank of said pin. Preferably the injection moulding joint line for the ball portion is arranged to occur along two diametrically-opposed portions of the annular torus which have a surface curvature less curved than the curvature of the remainder of the annular torus.

The invention and how it may be performed are hereinafter particularly described with reference to the accompanying drawings, in which:

Figure 1 is an elevational view of a windscreen wiper linkage assembly including ball and socket joint assemblies according to the present invention;

Figure 2 is a view of a windscreen wiper linkage assembly shown in Figure 1 taken along the line 2—2 in Figure 1;

Figure 3 is an enlarged cross-sectional view of a ball portion of the ball and socket joint assembly according to the present invention;

Figure 4 is a plan view of the ball portion shown in Figure 3 taken along the line 4—4 of Figure 3;

Figure 5 is a cross-sectional view of the ball portion shown in Figure 3, taken at right angles to the view shown in Figure 3;

Figure 6 is a plan view of the ball portion shown in Figure 5 taken along the line 6—6 of Figure 5; and

Figure 7 is an enlarged cross-sectional view of one of the ball and socket joint assemblies according to the invention and as shown in Figure 1 and 2.

Figure 1 and 2 of the accompanying drawings show two views of a typical single drive double output windscreen wiper linkage assembly 10 fitted with ball and socket joint assemblies 24 according to the present invention. An electric drive motor (not shown) is coupled to one end of a drive link arm 12 by means of a rotary drive link (not shown) and a ball and socket joint assembly according to the present invention, of which only a socket portion 26 is shown in Figures 1 and 2.

The other end of the drive link arm 12 is pivotally connected to one end of the cross bar of a T-shaped link plate 14 by means of a second ball and socket joint assembly 24. The end of the base of the T-shaped plate 14 is connected to drive shaft 16 of a first windscreen wiper arm and blade (not shown), and the other end of the cross bar of the T-shaped plate 14 is pivotally connected to one end of a drive transfer link arm 18 by means of a third ball and socket joint assembly 24. The other end of drive transfer link arm 18 is pivotally connected to one end of a link 20 by means of a fourth ball and socket joint assembly 24, the other end of which link 20 is connected to a drive shaft 22 of a second windscreen wiper arm and blade (not shown). Operation of the electric drive motor causes reciprocatory movement of drive link arm 12, which movement is transferred through the intervening ball and socket joint assemblies 24 to the link plate 14 and link 20 to cause corresponding oscillatory movement of drive shafts 16 and 22.

Turning now to Figures 3 to 6 of the accompanying drawings, these show enlarged cross-sectional elevation and plan views of a ball portion 28 of the ball and socket joint assembly 24, taken from two directions mutually at right

angles to one another. The ball portion 28 shown in Figure 3 comprises an acetal copolymer containing therein a bearing lubricant material, injection moulded about a zinc-coated mild steel pin 30. Pin 30 has an integral flange 32 formed adjacent one end 33 thereof and a shank portion 34, a portion 36 of the surface of which, intermediate the flange 32 and the other end 38 thereof, is heavily knurled. The acetal copolymer forming the ball portion 28 is injection-moulded in place about the knurled portion 36 of the shank portion 34 and is thus securely locked in position on the pin 30 against any movement relative to the pin 30.

In a preferred embodiment of the present invention, the ball portion is formed from an acetal copolymer containing polytetrafluoroethylene dispersed therein as a bearing lubricant, which is manufactured and sold by Hoechst Chemicals under the trade name of Hostaform (registered trade mark) C9021 TF. Other bearing lubricant materials, such as molybdenum disulphide, could be used in place of polytetrafluoroethylene.

The physical properties of Hostaform C9021 TF are as follows:

Density	1.52 g/cm^3
Water absorption after 24 hours	— mg
Water absorption after 96 hours	20 mg
Melt index MF1 190/2, 16	8 g/10 mins
Yield stress	53 N/mm^2
Elongation at break	20—25%
Limiting flexuralstress	94 N/mm^2
Torsional stiffness at 23°C	750 N/mm^2
Torsional stiffness at 120°C	— N/mm^2
Bend creep modulus, 1 mm value	2600 N/mm^2
Ball indentation hardness, 30 secs. Value	133 N/mm^2
Shore hardness	80
Impact strength	30 mJ/mm^2
Notched impact strength at 23°C	4.5 mJ/mm^2
Dynamic friction coefficient against rotating steel shaft (roughness depth $\approx$ 2.5 μm)	0.2—0.25
Dimensional stability under heat (Martens method)	76°C
Dimensional stability under heat (heat distortion temperature)	115°C
Vicat softening point VSP/B	115°C
Crystalline melting range	164—167°C
Coefficient of linear expansion 20—100°C	1.1 x 10^{-4}
Thermal cavity at 20°C	0.31 W/m.K
Specific heat at 20°C	1.47 kJ/kg.K
Volume resistivity	10^{15} Ω cm
Surface resistance	10^{13} Ω
Dielectric constant	3.6

Injection-moulding of the ball portion 28 about the pin 30 takes place in an accurately-shaped insert mould which is designed to mould the ball portion 28 in the form of an annular torus, a major portion of which has a predetermined surface of curvature 40 which accurately corresponds to the surface of curvature 41 of the socket portion 26 shown in Figures 1, 2 and 7 of the accompanying drawings. Two minor portions of the annular terms diametrically opposite one another each have a surface of curvature 42 which is less curved than the surface of curvature 40, as can be clearly seen in Figures 3, 4, 5 and 6 of the accompanying drawings. The inset mould for the ball portion is so designed that the flash line produced on the surface of the as-moulded ball portion 28 is located within said minor portions of the annular torus. Since the surface of curvature 42 is less than the surface of curvature 40, such a flash line will not make contact with the corresponding surface of curvature 41 of the socket portion 26 during use of the ball and socket joint assembly 24. Consequently, there is no need to burnish or otherwise machine the as-moulded ball portion 28 to remove the flash line thereon.

Assembly of the ball and socket joint assembly 24 is carried out by the direct insertion of the ball portion 28 as a snap-fit in the socket portion 26, which socket portion is made from a mouldable non-metallic composition such as a 30% by weight glass fibre-filled Nylon 12 synthetic polymer. Such compositions are obtainable from manufacturers such as Hüls (U.K.) Limited and Vestamid. A cross-sectional view of the assembled ball and socket joint assembly 24 is illustrated in Figure 7 of the accompanying drawings, which shows the fourth ball and socket joint assembly 24 of the Figures 1 and 2. As can be seen from Figures 7, the ball portion 28 of the ball and socket joint assembly 24 is secured to the link 20 by passing the end 33 of the pin 30 through a suitable aperture in the end of link 20 until the flange 32 of the pin 30 contacts the link 20 and then rivetting over the end 33 to clamp the pin 30 in position on link 20.

The ball and socket joint assembly of the present invention represents a marked improvement over known ball and socket joint assemblies for windscreen wiper linkages as regards ease of manufacture, cost of manufacture and service life. The pin supporting the ball portion is of relatively cheap material and is easy to manufacture, being of zinc-plated mild steel which is cold-headed to shape rather than turned, and the ball portion is rapidly and reproducibly injection-moulded on the pin to the correct working dimensions without further surface treatment. The acetal co-polymer of the ball portion has both dimensional stability and toughness exceeding that of synthetic polyamides such as Nylon, with substantially no appreciable water absorption or shrinkage. Moreover a useful feature of the present invention resides in the fact that the material of the ball portion has sufficient flexibility to compensate for the tendency of the moulded socket portion to distort from a circular shape to an oval shape on removal from the mould. This, in turn, means a better torque output from such a joint assembly compared to known ball and socket joint assemblies.

CLAIMS

1. A windscreen wiper linkage ball and socket joint assembly comprising a socket portion formed from a mouldable non-metallic synthetic composition and a ball portion formed by injection-moulding about a knurled shank of a metal pin an acetal copolymer containing dispersed therein a bearing lubricant material.

2. A windscreen wiper linkage ball and socket joint assembly according to claim 1, in which the acetal copolymer contains polytetrafluoroethylene dispersed therein.

3. A windscreen wiper linkage ball and socket joint assembly according to claim 1 or 2, in which the shape of the ball portion is that of an annular torus surrounding the shank of said pin.

4. A windscreen wiper linkage ball and socket joint assembly according to claim 3 in which two diametrically opposed minor portions of the annular torus each have a surface of curvature that is less curved than the remaining surface of curvature of the annular torus, and the injection-moulding joint line of the ball portion is located within the surface area of these two minor portions.

5. A windscreen wiper linkage ball and socket joint assembly according to any one of the preceding claims, in which the socket portion is formed from a glass-filled polyamide synthetic material.

6. A windscreen wiper linkage ball and socket joint assembly substantially as hereinbefore particularly described and as shown in Figures 1 to 7 of the accompanying drawings.

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